

NASA Astrobiology Early Career Collaboration Award Report
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Upon arriving at GSFC I presented a seminar to Harley Thronson's ATLAST (Advanced Technology Large-Aperture Space Telescope) study team, as intended. The seminar was attended by various planetary scientists and astronomers, including some from other NASA centers via teleconference, and was followed by a lengthy discussion. I presented work on atmospheric disequilibrium biosignatures and exoplanet photometry, but our research on photometry seemed to generate the most interest. There were a lot of questions about the applicability of our results to future direct imaging missions such as ATLAST/LUVOIR. For instance there were questions on the simultaneous use of photometry and spectroscopy to characterize exoplanets, and confounding variables such as the effect of clouds and viewing phase. These questions helped shape the focus of our first paper on exoplanet photometry, which is currently in preparation.

Additionally, following discussions at GSFC I am in ongoing conversation with Shawn Domagal-Goldman about collaborating on a second paper on exoplanet photometry. The idea is to use the results from our first color-optimization study in combination with his comprehensive telescope noise model to incorporate photometry metrics into observing strategies for ATLAST/LUVOIR. In particular, we want to know if photometry can be used to help identify potentially Earth-like exoplanets for more detailed spectroscopic observations. This study will help inform telescope design by determining the telescope parameters required for photometric characterization. We also discussed the possibility of future collaboration on another project on quantifying interactions between the biosphere and environmental conditions.

I had productive meetings with many other researchers during my time at GSFC. For instance, I met with Vladimir Airapetian and heard about his work on modeling the effect of solar activity/high energy particle fluxes on atmospheric composition. We discussed the possibility of applying our disequilibrium model to quantifying the chemical disequilibrium produced by solar activity on the early Earth. I also met with Alex Pavlov and learned about his research on biomarker survivability in the Martian subsurface due to cosmic ray bombardment. This work has relevance to a future project I wish to explore on disequilibrium in Mars' atmosphere.

Finally, I also had the opportunity to sit in on a mission development meeting. This was a fascinating introduction to the politics of mission planning.

In summary, my short visit to GSFC was highly productive. The discussions I had with NASA scientists have shaped the direction of my future research and opened up several avenues for continued collaboration.